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COLLECTION, EXTRACTION, AND YIELD OF BLACK LOCUST SEED

By Leonard F. Kellogg, Silviculturist

Increased demand for nursery stock for erosion control planting has emphasized the need for and the value of good seed of black locust. Many forestry agencies can wisely and profitably collect their own seed supplies locally. Some are now following this procedure, with the advantage of obtaining seedling stock from known strains of locust adapted to and established in the locality. To aid them, available data on the collection, extraction, cleaning, and yield of black locust seed have been assembled.

Collection. In choosing trees from which to collect seed, search for those that are straight, healthy, thrifty, and rapidly growing. Weakened, poorly formed, and slowly growing trees may produce inferior seed. Endeavor to select seed trees at least ten years old and preferably older, since young trees probably do not produce as much seed of as high quality as do older trees. Last but not least, endeavor to collect large, well filled seed, since these produce superior seedlings. Where unusually good seed trees are found, they should be preserved if possible for future seed crops. Desirable qualities, such as early maturity of seed, complete and prompt germination, permeable seed coats, superior growth rates, and others, can be discovered only by careful, continual observations on seeds and seedlings of known parentage.

The ripened pods of black locust may be collected either from standing trees or from cuttings which are made after the seed has ripened. Hand picking often will be found to be a feasible method, especially where seed of exceptional quality has been located, although it will prove more expensive than collecting from cuttings, provided the latter are available. However, since there are so many black locust seeds in a pound (ranging from about 16,000 to 33,000 or more), the difference in cost of seed per thousand seedlings produced therefrom is not a very serious matter, provided that seed of a superior strain is obtained and treated to obtain high germination. First class seedlings from superior seed are well worth a slightly higher cost incurred in collection.

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In hand picking, if the tree is small one man can work alone from a ladder or by climbing. A sack hung across the shoulder by means of a piece of rope provides a convenient container for pods. On larger, more heavily yielding trees, an 8-foot pole tree pruner has proven very effective. The climber clips off small twigs bearing clusters of pods, which are gathered together later on the ground; or they can be collected simultaneously by a co-worker on the ground and clipped off with shears into sacks. The elimination of unnecessary twigs, sticks, and stems at the time of collection simplifies seed extraction later. Seed from the middle and upper portion of the tree crown is probably better than that from the lower limbs.

The output from hand picking varies according to the seed crop, size of trees, equipment used, ability of the pickers, and other factors. Over a period of several years collections have been made by Kellogg and Hall of this Station at the rate of from 1.5 to 3.2 pounds of pods per man hour. C. F. Olsen reports(1) collecting a truckload of locust pods in Mississippi at the rate of about 2.7 pounds per man hour, using colored labor. On the basis of these experiences, one man may be expected to hand pick from 12 to 25 pounds of pods in an 8-hour day, which should yield on the average from 3 to 6 pounds of seed.

Collecting pods from felled trees can be done more rapidly and at less cost. Ordinarily pods are picked directly into containers or sacks, although Hall used a somewhat different method in collecting seed from a 13-year-old locust plantation. As the trees were felled, pod-ladened limbs were cut off and the pods were flailed off with sticks over a 14 x 16 foot canvas stretched on level ground. This collection was made at the average rate of 6.3 pounds of pods per man hour. This method resulted in sticks and twigs being mixed with the pods, which interfered with the threshing operation; it was necessary to separate the trash from the pods at a cost of 3 cents per pound of seed.

In collecting seed from large roadside trees to be felled, a C.C.C. crew in southern Indiana used a block and tackle to lower the trees gently to prevent shattering of pods and loss of seed. The yield of seed was reported to be about four times greater than that from trees allowed to fall in the usual way with the attendant shock and jar.

Extraction. Seed of black locust may be extracted from pods either by an ordinary grain separator where quantity output is concerned, by a home-made thresher designed at this Station for smaller quantities of pods, or by hand flailing. Bean separators are less satisfactory, but they can be used if necessary.

Preliminary tests by this Station in 1933 indicated that an ordinary threshing separator is the best means of extracting seed on a large scale. Experience of many agencies has verified this opinion. The use of a Case

(1) Journal of Forestry, Vol. 32, No. 1, pp. 97-98.

separator was successfully demonstrated by C. F. Olsen of the Southern Forest Experiment Station, and D. A. Oliver similarly has used this method for extracting locust seed at the Parsons Nursery, Monongahela National Forest. State agencies have used the same means. A clover-huller attachment tried out in one instance did not work successfully in threshing locust pods; most of the seed was broken and ground up. Hall used a bean separator in threshing 3200 pounds of pods in 1934, with fair results. For large scale extraction a grain separator is the best and cheapest mechanical means available.

Breakage of seed may occur in threshing, but loss in this operation need not be tolerated. As much as 25 per cent of the seed has been broken in threshing small samples of pods in a small experimental separator. If a preliminary test run of the machine shows serious seed breakage, adjustment or removal of part of the machine's concaves should be made to correct the difficulty.

It is quite possible not only to thresh the locust pods, but also to clean the seed of foreign material in one operation. In Olsen's test, the seed was sufficiently cleaned that no further treatment was necessary. The best arrangement of screens in the machine was found to be a 1-inch lip screen on top, a 3/8-inch lip screen on the middle, and a 1/4-inch round hole screen on the bottom. The blower was half closed to prevent seed losses from excessive air draft. At the Parsons Nursery, Oliver found it necessary to clean the locust seed with a fanning mill after threshing. The screen arrangement used in his case is not known. Hall found it necessary to clean the pods of foreign material before his threshing operation in 1934. Apparently a competent thresher can combine or substitute his screens, adjust the concaves, adjust the blower draft, and regulate the speed of the machine so that threshing and cleaning can be done in one operation. The cost of seed can be reduced by attention to this detail.

Relatively few data are available on the cost of machine threshing. In Mississippi, Olsen found in threshing a truckload of locust pods in 1933 that the actual cost of labor and operation, but including no depreciation or supervision, was $0.0053 per bushel ($0.0012 per pound of seed). Oliver, in West Virginia, contracted for the threshing of 2,481 bushels of locust pods in 1933 for 2 cents per bushel ($0.008 per pound of seed). Hall's threshing operation in 1934 in Ohio, using a bean separator, cost $0.0275 per pound of seed.

A small, home-made thresher of black locust seed, designed at this Station[1] by B. F. Myer, is capable of threshing about 50 pounds of dry locust pods per hour, at an estimated cost of $0.04 per pound of seed. This machine permits the threshing of individual quantities of pods too small for a grain separator, and permits segregation of separate seed

(1) Station Note No. 27: "A Home-Made Thresher for Black Locust Seed Pods."

yields. At the same time, it is a far cheaper and faster method of extraction than flailing. After threshing, the seed is separated from pod chips and cleaned in a fanning mill.

The use of an old-fashioned flail for threshing black locust seed has proven effective for a small quantity of pods. A similar method consists of beating the pods in a tight grain sack with a club, working over and reworking the matrix of thoroughly dried pods and seed until all the seed is jarred loose. Since the volume of pods decreases as the beating progresses, it is necessary to tighten the string or add more pods to keep the matrix together. When all the seed is jarred loose, it can be separated from the pod chips in a fanning mill.

The cost of threshing locust seed by hand is considerably higher than by machine because of the time element. However, an excellent quality of work can be done by hand with little or no breakage of seed. Cleaning requires additional time.

Where it is necessary to clean the seed as a part of or following threshing, care in choosing the screens which are used will facilitate the cleaning operation. In the "Clipper" machine used for cleaning small quantities of seed at this Station, best results have been obtained with round-holed screens using on the top a #14 and on the bottom a #6 or #7, depending on the size of the seed. A #8 bottom screen may give better results when the seeds are unusually large.

Yield of Pods. Few data are available on yield of pods, especially for individual trees. The yield, of course, varies with the size of tree crown, and from year to year. In Ohio as much as 30 to 35 pounds of pods have been collected from single trees. In 1934, Hall recorded the amount of pods and seed produced on 18 acres of borer-damaged plantations which he clear cut in Ohio. The trees were spaced 10' x 10', and averaged 20 feet in height and 4 inches in diameter. The production of pods ranged from 152 to 209 pounds per acre and averaged 179 pounds; the yield of seed ranged from 22 to 31 pounds per acre and averaged 26 pounds.

Yield of Seed. The yield of black locust seed varies greatly with locality, seed year, size and thrift of parent tree, variety or strain, and probably other factors. One might expect yields of seed by machine threshing to be lower than those by hand methods; but the degree of filling of the pods, size of seed, and other factors appear to be of greater importance on yield than method of threshing, provided the seed is not broken in the process. In the following table, data on yields which have been obtained from the seed crops of 1933, 1934, and 1935 are summarized.

Some Yields of Seed from Black Locust Pods
Seed Crops of 1933, 1934, and 1935

Source	Seed Locality	Seed Year	Quantity of Pods in Test		Method of Extraction	Yield of Seed		
						Total	Per bu. of Pods	Per 10 lbs. of Pods
			Lbs.	Bu.		Lbs.	Lbs.	Lbs.
Olsen (1)	Miss.	1933	12.8	1.2	Hand	3.6	3.00	2.81
"	"	1933	14.1	1.4	"	4.0	2.86	2.84
Oliver(2)	Va.	1933	-	13	Separator	65.	5.00	-
"	W.Va.	1933	-	645.	"	1736.	2.69	-
"	-	1933	-	1823.	"	4346.	2.38	-
Hall	Ohio	1934	3364.	-	Bean Separator	496.	-	1.48
"	"	1934	5.	-	Hand	1.35	-	2.70
"	Ill.	1934	79.	8.	"	23.2	2.90	2.94
Kellogg	Ohio	1933	15.6	-	"	3.5	-	2.24
"	"	1933	10.5	-	"	2.45	-	2.33
"	Wis.	1934	6.83	-	"	2.50	-	3.66
"	Ohio	1935	14.75	-	Myer Thresher	1.97	-	1.34
"	"	1935	10.25	-	" "	2.28	-	2.22
"	"	1935	12.25	-	" "	2.93	-	2.39
"	"	1935	11.0	-	" "	1.70	-	1.54
"	"	1935	72.0	-	" "	16.26	-	2.26
"	"	1935	31.5	-	" "	11.75	-	3.73
"	"	1935	31.5	-	" "	9.17	-	2.91
"	"	1935	21.5	-	" "	4.93	-	2.29

(1) Jour. of For., Vol. 32 (1): 97-98.
(2) At Parsons Nursery, W. Va.

The yields of seed in the above samples have been calculated and found to vary from 1.34 pounds to 3.73 pounds of seed per 10 pounds of dry pods. On a basis of volume, the yield varies from 2.38 pounds to 3.00 pounds of seed per bushel for the samples where volume was recorded, although one sample indicates a yield of 5 pounds of seed per bushel of pods. Weight is a preferable basis for calculation because of the differences in amounts of pods which can be packed into a bushel measure; yet moisture content is an important variable in calculations on a basis of weight.

All data at hand (including those in the Table) have been compiled to determine the average yield of seed to be expected. Most of these data are from southern Ohio, and apply to that locality. On a basis of 42 samples, the mean or average yield from 10 pounds of dry pods is 2.50 pounds with a standard deviation of $\pm$ 0.534 pounds. Olsen found that a 32-quart bushel of freshly threshed black locust seed weighed about 45.8 pounds. Hall found that a bushel of pods weighed about 9 to 10 pounds, and Olsen's tests at Holly Springs, Mississippi, indicate about the same, although in one case a bushel weighed only 5 pounds.